Parkinsonism

Evaluation and Treatment of Movement Disorders

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■ *Patients with movement disorders from parkinsonism were treated with thalamotomy performed by stereotactic surgical procedure. In order to determine with any degree of objectivity the results of these lesions, an accelerometer was used to record hand tremor and various mechanical tests were carried out that included self-care activities to evaluate impairment of function. On the basis of these tests, patients were selected for surgical operation, their condition before and after operation was evaluated, and a program for their rehabilitation was drafted.*

WITH THE ADVENT of stereotactic surgical procedures, the means of evaluating the condition of patients with parkinsonism have become more discerning, with greater emphasis being placed on objectivity.

Webster,[8] Boshes,[1] Burns[3] and Brumlik[2] used such aids as myographs, electromyography, accelerometers, strain gauges, motion movies and dynamometers for measuring tremor, rigidity and strength in the muscles at rest and during isolated movements of the extremities. England[4] and Schwab[5,6,7] combined these measurements with tests of performance —handwriting tests, the ability to draw triangles and circles, measuring the time a patient took to dress, wash and eat and observing aptitude in indoor and outdoor activities, occupational duties and chores. The timed tests were graded on a percentage basis.

The patients we deal with are studied in a similar manner. Immediately before, during and at some time after thalamotomy they are tested with a microminiature accelerometer weighing 2.75 grams that is attached to the involved finger, and a tracing is made

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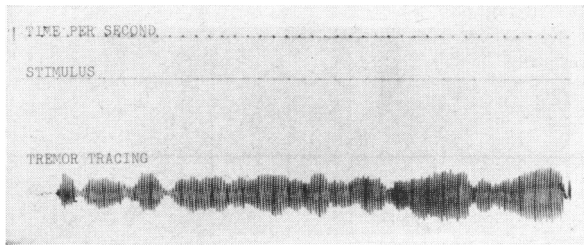

Figure 1.—Tracing of finger tremor in Parkinson's disease. Tracings made before, during and immediately after operation are analyzed with regard to degree and rate of tremor and fine irregularities within the gross tremor. The stimulus consists of an electrical current of negative rectangular pulse of one millisecond duration and amplitude varying from 0.5 to 10 volts.

of the tremor (Figure 1). The tracing is analyzed as to degree and rate of tremor and the irregularities in the jerky motion within the gross tremor.

Tests for impairment of normal function also are done. Some of the activities that have to do with self-care are tested in occupational therapy, and others that include activities of daily living as well as gait and stairclimbing are tested in physical therapy.

In each case we chart data of four categories. Representing a preliminary protocol with results from simplified tests, these charts provide us with a gross evaluation of important functions arranged to facilitate a rapid analysis. Some of the charted data is based on actual timing of a performance, some on the configuration of a graphic record on paper and some on the investigator's interpretation of the patient's ability to perform certain actions. (See Charts 1, 2, and 3.

Chart 1 is a record of pertinent information about the patient, his age and the side of his brain that is operated upon. The patient's ability to coordinate his hands and arms is tested in a pegboard exercise, in bringing a cup or a spoon to his mouth, in cutting meat and in clashing cymbals. In these tests, tremor is usually the chief interfering factor, whereas in dressing and undressing, balance is important and rigidity becomes a factor. Almost all the patients have difficulty with buttoning and unbuttoning their clothes and with tying shoe laces. Measurement of reasoning is done by a simple psychological exercise to determine the presence of intellectual deterioration, emotional instability or loss of memory. These tests are done immediately before operation, a day or two after operation and again about two to three weeks later. If and when the patient is transferred to outpatient status, he is tested during follow-up visits, which may continue for months and years.

Chart 1 is also the form for reporting on the usual functions carried out by the patient for personal hygiene, such as washing his hands, brushing his teeth, combing his hair and shaving. Here the therapist makes comments about the patient's performance. As the patients are usually unable to make a to and fro rubbing motion while washing, they prefer to pat the face and neck with the washcloth. In brushing the teeth and in shaving, most patients prefer to use electric appliances. Any simulated or substituted motion to achieve the desired function should be described by the therapist. Speech function is based on the articulatory and the phonatory abilities of the patient, along with the correct coordination of breathing with phonation. A specimen of the patient's handwriting and of his ability to draw lines to connect points are useful for appraising tremor.

Chart 2 combines clinical impressions of tremor, rigidity, sialorrhea and other signs with a summary of the patient's performance in activities related to self care. The purpose of this form is to provide a quick over-all record on which to base postoperative assessment of activity.

Chart 3 is for recording the testing of functions that require movement of the entire trunk and extremities as required in the activities of daily living: ability to sit with and without support, to stand up from a chair, to walk, climb stairs or inclines and avoid obstacles, to coordinate hand and leg movements as when catching a medicine ball, and to respond to commands that may require the performance of two actions at the same time. For a patient with parkinsonism the latter is a difficult feat, for movements are usually carried out separately and in sequence rather than simultaneously.

The evaluation drawn from the charted information is of value in three ways: (1) for proper selection of patients for surgical procedures; (2) for the assessment of benefits from operation; and (3) for the establishment of guides in the planning of a rehabilitation program for the patient. In evaluating these patients, however, it is important to remember that they perform best when they are relaxed and in familiar circumstances. Conversely, their symptoms become aggravated and their performances are reduced when they are emotionally upset and tense and possibly embarrassed about their inadequacies.

The physical evaluation of a patient with parkinsonism presents only one facet of his dislocation from normal living habits. Social, psychological and vocational assessments are also carried out concurrently with the physical evaluation of the functional activities, and they play an important role in the establishment of a rehabilitation program for each patient. However, these factors will not be elaborated on here, since the purpose of this communication is to present our methodology in testing patients with parkinsonism from the standpoint of performance

CHART 1.—*Evaluation for Parkinson's Disease (Occupational Therapy)*

Name: Age:
Unit number: Date:
Hand dominance: Side operated on: Reaction time:
Grading key: GOOD FAIR POOR SLURRED

	Pre-operation	*Post-operation I*	*Post-operation II*
Co-ordination	Date:___	Date:___	Date:___
Eye-hand (timed):			
Pegboard (12 1¼″ pegs)....	R_____ L_____	R_____ L_____	R_____ L_____
Hand-to-mouth:			
Cup-to-mouth	_____	_____	_____
Spoon-to-mouth	_____	_____	_____
Bi-lateral:			
Cymbals	_____	_____	_____
Cutting meat	_____	_____	_____
Dressing (Bi-lateral activities)			
Montessori Board (timed):			
Unbutton 2 large buttons.....	_____	_____	_____
Button 2 large buttons.....	_____	_____	_____
Unbutton 3 small buttons....	_____	_____	_____
Button 3 small buttons.....	_____	_____	_____
Activities of Daily Living			
Unbutton shirt	_____	_____	_____
Remove	_____	_____	_____
Place	_____	_____	_____
Button	_____	_____	_____
Tie shoe laces.....	_____	_____	_____
Reasoning			
9-piece puzzle (timed).....	_____	_____	_____
Orientation	_____	_____	_____
Memory	_____	_____	_____
Personal Hygiene			
Wash hands	_____	_____	_____
Brush teeth	_____	_____	_____
Shave	_____	_____	_____
Comb hair	_____	_____	_____
Communication			
Speech	_____	_____	_____

HANDWRITING SAMPLE

Pre-operation	*Post-operation I*	*Post-operation II*

CONNECT DOTS WITH LINES

Pre-operation		*Post-operation I*		*Post-operation II*	
•	•	•	•	•	•
•	•	•	•	•	•
•	•	•	•	•	•

COMMENTS:

CHART 2.—*Evaluation for Parkinson's Disease (Occupational Therapy)*

SUMMARY OF FINDINGS

KEY: Underline with—
Red for Pre-operation
Green for Post-operation I
Blue for Post-operation II

Name:
Unit #:

Tremor

With activity Present Absent Moderate Minimal Severe
Resting .... Present Absent Moderate Minimal Severe
Increased Decreased
Rigidity .....Slight Moderate Marked
*Bradykinesia** Slight Moderate Marked
Increased with activity Decreased with activity
Sialorrhea† ..Present Absent
Dressing ....Unassisted Partial assistance Great assistance Unable
Eating .....Unassisted Partial assistance Great assistance Unable

Problems due to—	*Pre-operation* Date:___	*Post-operation I* Date:___	*Post-operation II* Date:___
Rigidity	_____	_____	_____
Tremor	_____	_____	_____
Bradykinesia	_____	_____	_____
Mental changes	_____	_____	_____
Combination of one or more of the above.....	_____	_____	_____

Comments:

_____
Occupational Therapist

*Slowness of movement. †Drool

CHART 3.—*Evaluation for Parkinson's Disease (Physical Therapy)*

Name: Age:
Unit Number: Date:
Side operated on: Main complaint: Dominant side:
Grading key: GOOD FAIR POOR

	Pre-operation Date:___	*Post-operation I* Date:___	*Post-operation II* Date:___
Sitting:			
Backless chair	_____	_____	_____
Back chair	_____	_____	_____
Rise to standing.....	_____	_____	_____
Stationary Standing:			
Without motivation activity	_____	_____	_____
With motivation activity..	_____	_____	_____
Ambulation:			
General gait	_____	_____	_____
Stairs and inclines.....	_____	_____	_____
Avoid objects and obstacles	_____	_____	_____
Activities on Exercise Mats:			
Face lying	_____	_____	_____
Roll side to side.....	_____	_____	_____
Lying to sitting.....	_____	_____	_____
Creep and crawl.....	_____	_____	_____
Co-ordination Activities:			
Throw and catch.....	_____	_____	_____
Cycling	_____	_____	_____
Punching bag	_____	_____	_____
Command Activities:			
Walk (stop, start, etc.)...	_____	_____	_____
Sit, stand, etc.....	_____	_____	_____
"Simple Simon"	_____	_____	_____

Comments:

of the activities of daily living combined with specific recordings of hand tremor.

On the basis of very similar tests, Schwab concluded that the patient best suited to surgical treatment is the one with unilateral signs only. He expressed belief that only one per cent of all patients with parkinsonism are ideal candidates for operation and only ten per cent are reasonably good candidates.

From the standpoint of the value derived from stereotactic procedures, Schwab found that 70 per cent of the patients he kept under observation showed obvious benefit for as long as they were observed, which for some of them was nine years. Some of these patients had complete absence of rigidity and tremor and it was anticipated that this improvement was permanent. The mortality risk involved in the operation was given as 2 per cent, and the risk of iatrogenic deterioration of condition, such as aggravation of muscle weakness and impairment of speech, was also reported as 2 per cent. Also, when the opposite side became involved at a later date, a second operation was indicated and this carried a slightly higher risk, especially with regard to involvement of speech.

From our own studies we would agree with Schwab that the best candidate for operation is the patient with unilateral signs. However, there are very few such patients; by far the majority of the patients we see have bilateral symptoms of tremor and rigidity in a moderately advanced stage. Certainly in evaluating the postoperative results in a patient who had only unilateral signs to begin with, an excellent result would be one in which all signs of tremor and rigidity were abolished. Yet in evaluating the postoperative result from the functional standpoint, the result would have to be considered "excellent" if a patient with severe bilateral involvement were brought back to the level of self sufficiency again, even though some tremor or rigidity persisted. Therefore, testing must be done in a way that measures not only functional result but, objectively, the changes brought about in each patient. It is not enough to try to state the condition of a patient merely by saying, for example, that tremor was 1 plus or 3 plus. Functions must be measured objectively, as we have been doing for the past two years, by utilizing newly available electronic techniques. This will make it possible to make objective comparison between the results reported at various treatment centers. Yet we must also keep in mind that scientific electronic measurements no matter how objective, do not measure the overall level of functional improvement, which is what the patient is most interested in.

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